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Does a patient's Mallampati score predict outcome after maxillomandibular advancement for obstructive sleep apnoea?

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Abstract

The Mallampati airway classification has been used to estimate the success of uvulopalatopharyngoplasty in patients with obstructive sleep apnoea (OSA) but its predictive value in maxillomandibular advancement has not been proved. We aimed to explore the association between preoperative Mallampati scores and surgical outcome after bimaxillary advancement for OSA. We retrospectively analysed data on 50 patients who had maxillofacial operations for OSA at our hospital and stratified them into two groups based on Mallampati scores: high (class III/IV) and low (class I/II). We compared pre- and postoperative apnoea/hypopnoea indices (AHIs), Epworth sleepiness scores, and lowest recorded oxygen saturation in both groups. The postoperative values for all three outcome measures were not significantly different when patients were stratified according to the Mallampati classification (mean (SD) AHI was 41(19) before and 7 (6) after operation in the low group, and 42 (15) before and 9 (7) after in the high group). Success rates (AHI less than 15 postoperatively) were similar in both low and high score groups ($p > 0.05$). Maxillomandibular advancement alleviates obstruction at multiple levels and our study has shown comparable surgical outcomes in both groups. The Mallampati score can be used to optimise patient selection for surgeons considering single-level procedures for OSA. Our study suggests that the Mallampati classification is less useful for the prediction of surgical outcome after maxillomandibular advancement surgery.

Keywords: Mallampati classification; Maxillomandibular advancment; Maxillofacial surgery; Obstructive sleep apnoea; Surgical outcome

Introduction

Obstructive sleep apnoea (OSA) is a common condition that affects 5% of the population.[1] It is characterised by partial or complete obstruction of the airway during sleep, and is associated with daytime sleepiness, poor quality of life, road traffic accidents, and an increased risk of cardiovascular and metabolic diseases.[1,2,3] Continuous positive airway pressure (CPAP) remains the treatment of choice, but long term compliance is a problem for many patients.

An increasing number of reports have highlighted the role of maxillofacial orthognathic surgery in the management of patients who have failed to tolerate or have declined treatment with CPAP, and previous studies have suggested success of 65%–100%.[4–8] This particularly applies to younger people who do not have risk factors that can readily be modified such as intake of alcohol, or those who do not have a high body mass index (BMI).[9] Currently, no widely agreed

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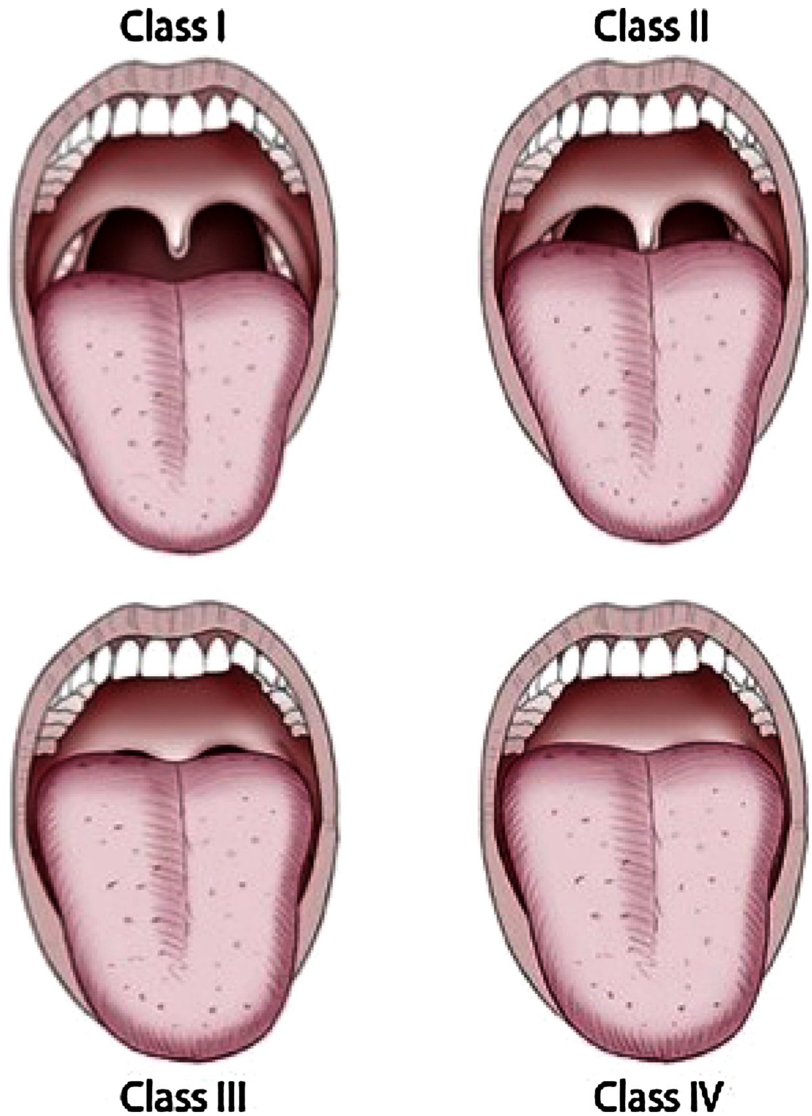

Fig. 1. Mallampati classification: class I: fully visible uvula and soft palate; class II: hard and soft palate, and upper portion of uvula are visible; class III: soft and hard palate and base of uvula are visible; class IV: only hard palate visible.

classification is used to predict operative outcome in patients undergoing maxillofacial surgery for OSA. Such information would be invaluable to referring clinicians and operating surgeons.

In patients with OSA, the Mallampati classification has been used to help identify the site of obstruction in the upper airway. It is a simple assessment tool that is widely used by anaesthetists to identify patients at risk of difficult tracheal intubation.[10] The grade is based on the concept of a large tongue relative to the oral cavity. Patients are asked to open their mouths as wide as possible and protrude their tongues as far forward as they can. A score (I–IV) is obtained by visual inspection of the soft palate, hard palate, and tongue (Fig. 1). Class IV typically indicates potentially difficult intubation as only the hard palate is visible.[10]

It has been hypothesised that patients with high Mallampati scores have a relatively narrow oral airway that can compromise breathing during sleep and predispose to snoring and OSA. Previously published research has shown an association between the score and the presence and severity of the disorder.[11,12] The modified Mallampati scale is one of three components that comprise the Friedman classification (along with BMI and size of tonsils),[13] and its use has been proposed to help predict outcomes in patients who have operations on the upper airway for snoring and OSA. In those with high Friedman scores (equivalent to Mallampati III/IV), authors have suggested that success of uvulopalatopharyngoplasty for OSA is less than 10%.[13,14]

To our knowledge, use of the Mallampati score as an independent predictor of outcome following bimaxillary advancement procedures has not previously been explored. We aimed to assess the association between the preoperative Mallampati score and outcome after maxillofacial orthognathic operations for OSA.

Method

We retrospectively reviewed the outcome of a consecutive group of patients who had orthognathic operations for OSA at our hospital between 2002 and 2012. All had been diagnosed after a sleep study, and had subsequently failed to comply with, or adhere to, long-term treatment with CPAP.

We retrieved relevant data from patients' medical records, which included characteristics, medical history, Mallampati score at initial presentation, and clinical and operative data. Sleep studies were repeated 6 months after operation to enable comparison of baseline and postoperative data.

We divided our patients into two groups based on the Mallampati classification: low scores (class I/II) and high scores (class III/IV). The predictor variable was the score at initial presentation and the primary outcome variable was postoperative apnoea/hypopnoea index (AHI) scores. Secondary outcome variables were Epworth sleepiness scores and lowest recorded oxygen saturation after operation.

The AHI is an objective measure of breathing during sleep and is derived from a sleep study. The frequency of periodic reductions (hypopnoea) or cessations (apnoea) in breathing secondary to obstruction of the upper airway, is used to assess the severity of the condition (mild = AHI 5–14/h, moderate = AHI 15–30/h, severe = AHI over 30/h). The Epworth sleepiness scale, a validated questionnaire that subjectively assesses the degree of daytime sleepiness, includes eight questions involving eight situations that are rated with possible total scores that range from 0 to 24. The normal range is a score between 0 and 10. We considered surgical success as AHI scores of less than 15 and a 50% reduction in the index from baseline, and surgical cure as an AHI score of less than 5.

Data were analysed with the help of SPSS for Windows version 10.1. Bivariate analysis was done to find an association between data from the postoperative sleep study and the Mallampati score. The independent sample *t* test was used to evaluate differences in continuous variables and the Fisher's exact test to compare categorical variables. Probabilities of less than 0.05 were considered significant.

Results

We identified 51 patients who had maxillofacial operations for OSA during the study period. Of these, data were available for 50. A total of 34 (68%) had low Mallampati scores (class I/II) and 16 (32%) had high scores (class III/IV).

The baseline characteristics of both groups stratified by Mallampati scores are shown in Table 1. Clinical data and information on the extent of maxillomandibular advancement are shown in Table 2.

The results of the analysis of the outcome variables (AHI, Epworth sleepiness scale, and lowest recorded oxygen saturation) when stratified by Mallampati scores are shown in Table 3. Postoperatively, AHI and Epworth scores in both groups were lower. Although values for oxygen saturation improved in both groups, the subjects with high Mallampati scores appeared to have a greater uplift in their oxygenation level, although this variance did not achieve statistical significance ($p = 0.09$).

All our patients except one reported an improvement in subjective symptoms after operation. AHI scores before and after operation were available for 39 of the 50 patients. Table 4 shows the rate of surgical success and cure when stratified by high and low Mallampati scores.

Table 1
Baseline characteristics of the study sample. Data are number (%) unless otherwise stated.

	Low score group (Mallampati I/II) ($n = 34$)	High score group (Mallampati III/IV) ($n = 16$)	p Value
Mean (SD) age (years)	43 (7)	47 (8)	0.08
Sex:			
Male	32 (94)	14 (88)	0.66
Female	2 (6)	2 (12)	
Mean (SD) BMI	29 (3)	28 (3)	0.78
Smokers	8 (24)	6 (38)	0.27
Alcohol	27 (79)	13 (81)	0.74
ASA ≤2	32 (94)	13 (81)	0.15
Coexisting conditions[a]	13 (38)	6 (38)	0.98
Previous operation	15 (44)	6 (38)	0.71
Preoperative PAS (mm)	6.3 (2.1)	7.0 (1.4)	0.64

BMI = Body mass index, ASA = American Society of Anaesthesiologists' physical status classification, PAS = posterior airway space (on lateral cephalogram).

[a] Cardiovascular or respiratory conditions, or both.

Discussion

The primary aim of this study was to assess use of the Mallampati score as an independent predictor of outcome in patients

Table 2
Orthognathic details of the study sample.

	Low score group (Mallampati I/II) ($n = 34$)	High score group (Mallampati III/IV) ($n = 16$)	p Value
Occlusion:			
Class I	23	9	
Class II	10	7	0.47
Edentulous	1	0	
Procedure:			
Bimaxillary advancement with genioplasty	26	15	
BSSO	5	0	0.66
Bimaxillary advancement	3	1	
Mean (SD) advancement (mm):			
Maxillary	8.2 (2.2)	7.7 (2.1)	0.41
Mandibular	8.5 (2.2)	8.0 (1.5)	0.48

BSSO = bilateral sagittal split osteotomy.

Table 3
Comparison of preoperative and postoperative outcome measures based on Mallampati groups. Data are mean (SD).

	Low score group (Mallampati I/II)	High score group (Mallampati III/IV)	*p* Value
Preoperative scores:			
Apnoea/hypopnoea index	41 (19)	42 (15)	0.95
Epworth sleepiness scale	15 (8)	14 (5)	0.36
Lowest recorded oxygen saturation (%)	75 (11)	77 (10)	0.59
Postoperative scores:			
Apnoea/hypopnoea index	7 (6)	9 (7)	0.51
Epworth sleepiness scale	6 (4)	4 (2)	0.15
Lowest recorded oxygen saturation (%)	81 (9)	85 (4)	0.09

who had maxillofacial operations for OSA. To our knowledge this has not been previously studied.

We found no significant difference in the mean preoperative values for the AHI, Epworth sleepiness scale, and lowest recorded oxygen saturation when stratified by high and low Mallampati scores. When we considered surgical success and cure we found no association between postoperative outcomes and preoperative Mallampati scores.

Lowest recorded oxygen saturation improved in both groups, although it was greatest in those with Mallampati scores III and IV. In a recent study, OSA was identified as an important risk factor for sudden cardiac death, and patients with a lowest nocturnal oxygen saturation of less than 78% were reported to have the highest risk.[15] Given the serious morbidity and mortality that can potentially arise from hypoxaemia in patients with OSA, it may be useful to further investigate this trend with a more highly powered study.

The Mallampati score predominantly remains a tool that helps anaesthetists to assess ease of intubation,[10] but since its inception it has been used more widely. It has been described as an independent predictor of the presence and severity of OSA[11,12,16] and it clearly has a role in the investigation of patients suspected to have the condition. This is potentially useful, as several recognised medical conditions – for example, narcolepsy, REM sleep disorder, hypothyroidism, and depression, present with overlapping symptomatology, which could confound accurate diagnosis.

Table 4
Comparison of surgical success and cure rates stratified by Mallampati scores. Data are number (%).

	Low score group (Mallampati I/II) ($n = 27$)	High score group (Mallampati III/IV) ($n = 12$)	*p* Value
Successful (apnoea/hypopnoea index <15):			
Yes	24 (89)	9 (75)	0.26
No	3 (11)	3 (25)	
Cured (apnoea/hypopnoea index <5):			
Yes	16 (59)	7 (58)	0.61
No	11 (41)	5 (42)	

In our study, assessment of the Mallampati score was performed in subjects in the upright position, as originally described. It could be hypothesised that in some patients the Mallampati score may have altered in the supine (sleeping) position. The published literature, however, suggests inconsistent results when the question of changes in Mallampati score between upright and supine position was investigated.[17,18] In general, upper airway muscle tone is preserved regardless of a patient's position when awake, but during sleep, obstruction of the upper airway in patients with OSA is a consequence of collapse of the pharyngeal airway secondary to a loss of muscle tone.

Traditionally, the most common operation for OSA has been uvulopalatopharyngoplasty, and one meta-analysis showed success of 40%.[19] Friedman et al recognised that success rates were low in unselected patients, and proposed a classification system based on the Mallampati score to optimise outcome.[13,14] Success of 8.1% has been reported in those with high Friedman scores (equivalent to Mallampati III/IV),[13,14] and this suggests that the Mallampati score can be useful in screening potential patients for the procedure, particularly as those graded as Friedman class 1 (low Mallampati scores) seem to do better. The Mallampati score has been described as a potent predictor in patients with nasal obstruction.[16]

A possible explanation for the lack of association between Mallampati scores and our selected outcome variables is that maxillomandibular advancement removes obstruction at multiple levels by increasing both the nasopharyngeal and hypopharyngeal spaces. Most patients with OSA have multiple levels of obstruction.[13,14]

Our data suggest that maxillofacial orthognathic surgeons should not be unduly influenced by preoperative Mallampati scores, as surgical outcomes were good in both high and low score groups. The scores do not predict successful outcome in patients undergoing maxillofacial orthognathic operations for OSA, but previously published reports suggest that they can be helpful in the assessment of patients for single-level interventions.

Conflict of interest

We have no conflicts of interest.

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